General

Guideline Title

Clinical policy: critical issues in the evaluation and management of adult patients presenting to the emergency department with suspected pulmonary embolism.

Bibliographic Source(s)

Fesmire FM, Brown MD, Espinosa JA, Shih RD, Silvers SM, Wolf SJ, Decker WW, American College of Emergency Physicians. Critical issues in the evaluation and management of adult patients presenting to the emergency department with suspected pulmonary embolism. Ann Emerg Med. 2011 Jun;57(6):628-52. [185 references] PubMed

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Clinical policy: critical issues in the evaluation and management of adult patients presenting with suspected pulmonary embolism. Ann Emerg Med 2003 Feb;41(2):257-70. [145 references]

Clinical policies are scheduled for revision every 3 years; however, interim reviews are conducted when technology or the practice environment changes significantly.

Recommendations

Major Recommendations

Definitions for the strength of evidence (Class I-III) and strength of recommendations (Level A-C) are included at the end of the Major Recommendations.

1. Do objective criteria provide improved risk stratification over gestalt clinical assessment in the evaluation of patients with possible pulmonary embolism (PE)?
   Level A recommendations. None specified.

   Level B recommendations. Either objective criteria or gestalt clinical assessment can be used to risk stratify patients with suspected PE. There is insufficient evidence to support the preferential use of one method over another.

   Level C recommendations. None specified.

2. What is the utility of the pulmonary embolism rule-out criteria (PERC) in the evaluation of patients with suspected PE?
   Level A recommendations. None specified.

Level B recommendations. In patients with a low pretest probability for suspected PE, consider using the PERC to exclude the diagnosis based on historical and physical examination data alone.

Level C recommendations. None specified.

3. What is the role of quantitative D-dimer testing in the exclusion of PE?
   Level A recommendations. In patients with a low pretest probability for PE, a negative quantitative D-dimer assay (high sensitivity [e.g., turbidimetric, enzyme-linked immunosorbent assay]) result can be used to exclude PE.

   Level B recommendations. None specified.

   Level C recommendations. In patients with an intermediate pretest probability for PE, a negative quantitative D-dimer assay (high sensitivity [e.g., turbidimetric, enzyme-linked immunosorbent assay]) result may be used to exclude PE

4. What is the role of the CT pulmonary angiogram of the chest as the sole diagnostic test in the exclusion of PE?
   Level A recommendations. None specified.

   Level B recommendations. For patients with a low or PE unlikely (Wells score ≤4) pretest probability for PE who require additional diagnostic testing (e.g., positive D-dimer result, or highly sensitive D-dimer test not available), a negative, multidetector computed tomography (CT) pulmonary angiogram alone can be used to exclude PE.

   Level C recommendations.

   1. For patients with an intermediate pretest probability for PE and a negative CT pulmonary angiogram result in whom a clinical concern for PE still exists and CT venogram has not already been performed, consider additional diagnostic testing (e.g., D-dimer*, lower extremity imaging, VQ scanning, traditional pulmonary arteriography) prior to exclusion of venous thromboembolism (VTE) disease.
   2. For patients with a high pretest probability for PE and a negative CT angiogram result, and CT venogram has not already been performed, perform additional diagnostic testing (e.g., D-dimer*, lower extremity imaging, VQ scanning, traditional pulmonary arteriography) prior to exclusion of VTE disease.

   *A negative, highly sensitive, quantitative D-dimer result in combination with a negative multidetector CT pulmonary angiogram result theoretically provides a posttest probability of VTE less than 1%.

5. What is the role of venous imaging in the evaluation of patients with suspected PE?
   Level A recommendations. None specified.

   Level B recommendations. When a decision is made to perform venous ultrasound as the initial imaging modality*, a positive finding in a patient with symptoms consistent with PE can be considered evidence for diagnosis of VTE disease and may preclude the need for additional diagnostic imaging in the emergency department (ED).

   * Examples of situations in which a venous ultrasound may be considered as initial imaging may include patients with obvious signs of deep venous thrombosis (DVT) for whom venous ultrasound is readily available, patients with relative contraindications for CT scan (e.g., borderline renal insufficiency, CT contrast agent allergy), and pregnant patients.

   Level C recommendations.

   1. For patients with an intermediate pretest probability for PE and a negative CT angiogram result, for whom a clinical concern for PE still exists and CT venogram has not already been performed, consider lower extremity venous ultrasound as an additional test to exclude VTE disease (see question 4 above).
   2. In patients with a high pretest probability for PE and a negative CT angiogram result, and CT venogram has not already been performed, perform additional testing to exclude VTE disease (see question 4). As one of these additional tests, consider lower extremity venous ultrasound to exclude VTE disease (see question 4 above).

6. What are the indications for thrombolytic therapy in patients with PE?
   Level A recommendations. None specified.

   Level B recommendations. Administer thrombolytic therapy in hemodynamically unstable patients with confirmed PE for whom the benefits of treatment outweigh the risks of life-threatening bleeding complications.*

   * In centers with the capability for surgical or mechanical thrombectomy, procedural intervention may be used as an alternative therapy.

   Level C recommendations.

1. Consider thrombolytic therapy in hemodynamically unstable patients with a high clinical suspicion for PE for whom the diagnosis of PE cannot be confirmed in a timely manner.
2. At this time, there is insufficient evidence to make any recommendations regarding use of thrombolytics in any subgroup of hemodynamically stable patients. Thrombolytics have been demonstrated to result in faster improvements in right ventricular function and pulmonary perfusion, but these benefits have not translated to improvements in mortality.

Definitions:

Strength of Evidence

Literature Classification Schema*

Design/Class	Therapy†	Diagnosis‡	Prognosis§
1	Randomized, controlled trials or meta-analyses of randomized trials	Prospective cohort using a criterion standard or meta-analysis of prospective studies	Population prospective cohort or meta-analysis of prospective studies
2	Nonrandomized trial	Retrospective observational	Retrospective cohort Case control
3	Case series Case report Other (e.g., consensus, review)	Case series Case report Other (e.g., consensus, review)	Case series Case report Other (e.g., consensus, review)

*Some designs (e.g., surveys) will not fit this schema and should be assessed individually.

†Objective is to measure therapeutic efficacy comparing interventions.

‡Objective is to determine the sensitivity and specificity of diagnostic tests.

§Objective is to predict outcome including mortality and morbidity.

Approach to Downgrading Strength of Evidence*

	Design/Class		
Downgrading	1	2	3
None	I	II	III
1 level	II	III	X
2 levels	III	X	X
Fatally flawed	X	X	X

*See the "Description of Methods Used to Analyze the Evidence" field for more information.

Strength of Recommendations

Level A recommendations. Generally accepted principles for patient management that reflect a high degree of clinical certainty (i.e., based on strength of evidence Class I or overwhelming evidence from strength of evidence Class II studies that directly address all of the issues).

Level B recommendations. Recommendations for patient management that may identify a particular strategy or range of management strategies that reflect moderate clinical certainty (i.e., based on strength of evidence Class II studies that directly address the issue, decision analysis that directly addresses the issue, or strong consensus of strength of evidence Class III studies).

Level C recommendations. Other strategies for patient management that are based on Class III studies, or in the absence of any adequate published literature, based on panel consensus.

There are certain circumstances in which the recommendations stemming from a body of evidence should not be rated as highly as the individual studies on which they are based. Factors such as heterogeneity of results, uncertainty about effect magnitude and consequences, and publication

bias, among others, might lead to such a downgrading of recommendations.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Pulmonary embolism

Guideline Category

Diagnosis

Evaluation

Management

Risk Assessment

Treatment

Clinical Specialty

Cardiology

Critical Care

Emergency Medicine

Pulmonary Medicine

Radiology

Intended Users

Physicians

Guideline Objective(s)

- To revise the 2003 clinical policy on the evaluation and management of adult patients presenting to the emergency department with suspected pulmonary embolism (PE)
- To focus on 6 areas of interest and/or controversy that have developed or still exist since the 2003 policy was formulated

Target Population

Adult patients presenting to the emergency department with signs or symptoms of pulmonary embolism (PE)

Note: This guideline is not intended to address the care of patients with PE in the presence of cardiac arrest or pregnancy, patients with absence of symptoms suggestive of PE, or pediatric patients.

Interventions and Practices Considered

Diagnosis/Evaluation

1. Risk stratification using objective criteria (e.g., Geneva score, Wells score, Kline rule, Pisa model) or gestalt assessment
2. Pulmonary embolism rule-out criteria (PERC)
3. Quantitative D-dimer testing (e.g., enzyme-linked immunosorbent assay [ELISA] or turbidimetric assays)
4. Computed tomography (CT) pulmonary angiogram
5. Venous ultrasound
6. Additional diagnostic testing:
    - Ventilation-perfusion (V/Q) lung scan
    - Lower extremity imaging
    - Traditional pulmonary arteriography

Management/Treatment

Thrombolytic therapy (as indicated)

Major Outcomes Considered

- Specificity and sensitivity of diagnostic procedures
- False positive and false negative test results
- Adverse events associated with treatment
- Mortality

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

This clinical policy was created after careful review and critical analysis of the medical literature. Multiple searches of MEDLINE and the Cochrane Library were performed. To update the 2003 American College of Emergency Physicians (ACEP) clinical policy, all searches were limited to English-language sources and human studies. Specific key words/phrases and years used in the searches are identified under each critical question (see the original guideline document). In addition, relevant articles from the bibliographies of included studies and more recent articles identified by committee members and peer reviewers are included.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Strength of Evidence

Literature Classification Schema*

Design/Class	Therapy†	Diagnosis‡	Prognosis§
1	Randomized, controlled trials or meta-analyses of randomized trials	Prospective cohort using a criterion standard or meta-analysis of prospective studies	Population prospective cohort or meta-analysis of prospective studies
2	Nonrandomized trial	Retrospective observational	Retrospective cohort Case control
3	Case series Case report Other (e.g., consensus, review)	Case series Case report Other (e.g., consensus, review)	Case series Case report Other (e.g., consensus, review)

*Some designs (e.g., surveys) will not fit this schema and should be assessed individually.

†Objective is to measure therapeutic efficacy comparing interventions.

‡Objective is to determine the sensitivity and specificity of diagnostic tests.

§Objective is to predict outcome including mortality and morbidity

Approach to Downgrading Strength of Evidence*

	Design/Class		
Downgrading	1	2	3
None	I	II	III
1 level	II	III	X
2 levels	III	X	X
Fatally flawed	X	X	X

*See the "Description of Methods Used to Analyze the Evidence" field for more information.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

All articles used in the formulation of this clinical policy were graded by at least 2 subcommittee members for strength of evidence and classified by the subcommittee members into 3 classes of evidence on the basis of the design of the study, with design 1 representing the strongest evidence and design 3 representing the weakest evidence for therapeutic, diagnostic, and prognostic clinical reports, respectively (see the "Rating Scheme for the Strength of the Evidence" field). Articles were then graded on 6 dimensions thought to be most relevant to the development of a clinical guideline: blinded versus nonblinded outcome assessment, blinded or randomized allocation, direct or indirect outcome measures (reliability and validity), biases (e.g., selection, detection, transfer), external validity (i.e., generalizability), and sufficient sample size. Articles received a final grade (Class I, II, III) on the basis of a predetermined formula, taking into account design and quality of study (see the "Rating Scheme for the Strength of the Evidence" field). Articles with fatal flaws were given an "X" grade and not used in formulating recommendations in this policy. Evidence grading was done with respect to the specific data being extracted and the specific critical question being reviewed. Thus, the level of evidence for any one

study may vary according to the question, and it is possible for a single article to receive different levels of grading as different critical questions are answered. Question-specific level of evidence grading may be found in the Evidentiary Table included online (available at: http://www.annemergmed.com).

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

This policy is a product of the American College of Emergency Physicians (ACEP) clinical policy development process, including expert review, and is based on the existing literature; when literature was not available, consensus of emergency physicians was used.

Rating Scheme for the Strength of the Recommendations

Strength of Recommendations

Level A recommendations. Generally accepted principles for patient management that reflect a high degree of clinical certainty (i.e., based on strength of evidence Class I or overwhelming evidence from strength of evidence Class II studies that directly address all of the issues).

Level B recommendations. Recommendations for patient management that may identify a particular strategy or range of management strategies that reflect moderate clinical certainty (i.e., based on strength of evidence Class II studies that directly address the issue, decision analysis that directly addresses the issue, or strong consensus of strength of evidence Class III studies).

Level C recommendations. Other strategies for patient management that are based on Class III studies, or in the absence of any adequate published literature, based on panel consensus.

There are certain circumstances in which the recommendations stemming from a body of evidence should not be rated as highly as the individual studies on which they are based. Factors such as heterogeneity of results, uncertainty about effect magnitude and consequences, and publication bias, among others, might lead to such a downgrading of recommendations.

Cost Analysis

Potential benefits of using a highly sensitive D-dimer as a screening test include decreased cost and radiation exposure; however, if the test is ordered indiscriminately on patients with very little or no risk for pulmonary embolism (PE), false-positive D-dimer results may increase the harms associated with unnecessary advanced imaging.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

Expert review comments were received from individual emergency physicians and cardiologists and from individual members of the American College of Chest Physicians, American College of Radiology, American College of Emergency Physician's (ACEP's) Emergency Ultrasound Section, and ACEP's Quality and Performance Committee. Their responses were used to further refine and enhance this policy; however, their responses do not imply endorsement of this clinical policy.

This clinical policy was approved by the ACEP Board of Directors, January 13, 2011.

Supported by the Emergency Nurses Association, March 17, 2011.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate evaluation and management of patients presenting to the emergency department with suspected pulmonary embolism (PE)

Potential Harms

- False-positive D-dimer results may increase the harms associated with unnecessary advanced imaging.
- There is a risk of serious bleeding complications with thrombolytic therapy.

Contraindications

Contraindications

Relative contraindications for computed tomography (CT) scan include borderline renal insufficiency, CT contrast agent allergy.

Qualifying Statements

Qualifying Statements

- This policy is not intended to be a complete manual on the evaluation and management of patients with suspected pulmonary embolism (PE) but rather a focused examination of critical issues that have particular relevance to the current practice of emergency medicine.
- It is the goal of the Clinical Policies Committee to provide an evidence-based recommendation when the medical literature provides enough quality information to answer a critical question. When the medical literature does not contain enough quality information to answer a critical question, the members of the Clinical Policies Committee believe that it is equally important to alert emergency physicians to this fact.
- Recommendations offered in this policy are not intended to represent the only diagnostic and management options that the emergency physician should consider. The American College of Emergency Physicians (ACEP) clearly recognizes the importance of the individual physician's judgment. Rather, this guideline defines for the physician those strategies for which medical literature exists to provide support for answers to the crucial questions addressed in this policy.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Mobile Device Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Fesmire FM, Brown MD, Espinosa JA, Shih RD, Silvers SM, Wolf SJ, Decker WW, American College of Emergency Physicians. Critical issues in the evaluation and management of adult patients presenting to the emergency department with suspected pulmonary embolism. Ann Emerg Med. 2011 Jun;57(6):628-52. [185 references] PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2003 Feb (revised 2011 Jun)

Guideline Developer(s)

American College of Emergency Physicians - Medical Specialty Society

Source(s) of Funding

American College of Emergency Physicians

Guideline Committee

American College of Emergency Physicians (ACEP) Clinical Policies Subcommittee (Writing Committee) on Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department With Suspected Pulmonary Embolism

ACEP Clinical Policies Committee (Oversight Committee)

Composition of Group That Authored the Guideline

Members of the American College of Emergency Physicians Clinical Policies Subcommittee (Writing Committee) on Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department With Suspected Pulmonary Embolism: Francis M. Fesmire, MD (Subcommittee Chair; Committee Co-Chair); Michael D. Brown, MD, MSc; James A. Espinosa, MD; Richard D. Shih, MD; Scott M. Silvers, MD; Stephen J. Wolf, MD; Wyatt W. Decker, MD (Committee Co-Chair)

Members of the American College of Emergency Physicians Clinical Policies Committee (Oversight Committee): Wyatt W. Decker, MD (Co-Chair 2006-2007, Chair 2007-2010, Co-Chair 2010-2011); Francis M. Fesmire, MD (Co-Chair 2010-2011); Michael D. Brown, MD, MSc; Deborah B. Diercks, MD, MSc; Barry M. Diner, MD, MPH (Methodologist); Jonathan A. Edlow, MD; Steven A. Godwin, MD; Sigrid A. Hahn, MD; Benjamin W. Hatten, MD (EMRA Representative 2008-2010); John E. Houghland, MD (EMRA Representative 2010-2011); J. Stephen Huff, MD; Eric J. Lavonas, MD; Gail Lenehan, EdD, RN, FAEN, FAAN (ENA Representative 2010-2011); Sharon E. Mace, MD; Edward Melnick, MD; Devorah J. Nazarian, MD; AnnMarie Papa, RN, MSN, CEN, FAEN (ENA Representative 2007-2010); Susan B. Promes, MD; Richard D. Shih, MD; Scott M. Silvers, MD; Edward P. Sloan, MD, MPH; Stephen J. Wolf, MD; David C. Seaberg, MD, CPE (Board Liaison 2006-2010); Robert E. O'Connor, MD, MPH (Board Liaison 2010-2011); Rhonda R. Whitson, RHIA, Staff Liaison, Clinical Policies Committee and Subcommittees.

Financial Disclosures/Conflicts of Interest

Relevant industry relationships: There were no relevant industry relationships disclosed by the subcommittee or committee members.

Relevant industry relationships are those relationships with companies associated with products or services that significantly impact the specific aspect of disease addressed in the critical question.

Guideline Endorser(s)

Emergency Nurses Association - Professional Association

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Clinical policy: critical issues in the evaluation and management of adult patients presenting with suspected pulmonary embolism. Ann Emerg Med 2003 Feb;41(2):257-70. [145 references]

Clinical policies are scheduled for revision every 3 years; however, interim reviews are conducted when technology or the practice environment changes significantly.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the American College of Emergency Physicians (ACEP) Web site .

ACEP clinical policies are available for mobile applications at the ACEP Web site .

Availability of Companion Documents

None available

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on June 5, 2003. The information was verified by the guideline developer on July 18, 2003. This NGC summary was updated by ECRI Institute on September 9, 2011. The updated information was verified by the guideline developer on November 30, 2011.

Copyright Statement

Disclaimer

NGC Disclaimer